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IS 12799 (1989): Recommended practice for impregnation of castings [MTD 14: Foundry]



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*Indian Standard*

**FOUNDRY — IMPREGNATION OF  
CASTINGS — RECOMMENDED PRACTICE**

भारतीय मानक

ढलाईशाला — ढलाईयों के संसेचन — सिफारिशी रीति

UDC 621·762·86-982 : 621·746

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**BUREAU OF INDIAN STANDARDS**  
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NEW DELHI 110002

*February 1990*

**Price Group 2**

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on 10 July 1989, after the draft finalized by the Foundry Sectional Committee had been approved by the Metallurgical Engineering Division Council.

Impregnation of casting may be required for one of the following three reasons:

- a) For recovery of ferrous or non-ferrous castings containing micro or macro porosity, where pressure tightness is mandatory.
- b) For sealing components to improve corrosion resistance and/or to render the surface suitable for subsequent surface treatment.
- c) Those components requiring impregnation and having been itemised at the design stage and the drawings of such components are marked with the legend 'Impregnate after machining'.

It was, therefore, felt that a standard describing the recommended practice for impregnation of castings would be of help to the foundries.

The following additional information has been given in Annexes A, B and C:

- a) Vacuum impregnation systems technical data,
- b) Properties of sealants, and
- c) Treatment cycle time-analyses.

In the preparation of this standard valuable assistance has been provided by Ultraseal (India) Pvt Ltd, Pune.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## *Indian Standard*

# FOUNDRY — IMPREGNATION OF CASTINGS — RECOMMENDED PRACTICE

### 1 SCOPE

**1.1** This standard covers the procedure to be adopted when reclaiming porous components (metallic, such as ferrous and non-ferrous castings, as well as non-metallic components) by impregnating with a sealant.

### 2 LIMITATIONS OF USE

**2.1** To reclaim castings having gross defects. The process does not contribute to the strength of faulty castings and, therefore, castings rejected on strength grounds shall not be considered for treatment. Cracked castings cannot be reclaimed by impregnation.

**2.2** Castings intended for service at temperature ranging from  $-50^{\circ}\text{C}$  to  $300^{\circ}\text{C}$  or above on continuous heating or cooling. For air or water cooled components, temperature up to  $750^{\circ}\text{C}$  can be withstood for short intermittent periods with particular variety of sealant (see Annex A).

### 3 CONDITION OF COMPONENTS BEFORE IMPREGNATION

**3.1** Components should be thoroughly cleaned of all metal, swarf, rust, sand particles, die penetrants, grease and dirt, and oil, including cutting fluids before being impregnated. Any casting which has not been sufficiently cleaned should not be impregnated.

**3.2** Cleaning and preparation of metal surfaces prior to impregnation:

- a) Vapour degreasing using trichloroethylene as the cleaning agent should be resorted to. Components should be vapour degreased for sufficient duration depending on the degree of contamination.

- b) *Dehydration*

If any traces of moisture appear to be present, the castings should be dehydrated in an oven at a temperature of about  $120^{\circ}\text{C}$  for sufficient duration depending upon the degree of moisture on the casting.

### 4. TERMINOLOGY

**4.1** For the purpose of this standard, the following definitions shall apply.

#### 4.1.1 Vacuum Impregnation

Impregnation achieved by drawing the impregnant into the component at a high

vacuum usually exceeding 755 mm mercury. This process should be used only with low viscosity impregnants. (Specific gravity—1.004 to 1.022).

#### 4.1.2 Vacuum/Pressure Impregnation

Impregnation achieved by drawing the impregnant into the casting at a vacuum of a minimum of 710 mm mercury followed by pressurization at a minimum 69.0 m bar.

#### 4.1.3 Internal Hydraulic Pressure Impregnation

Impregnation achieved by filling the casting with impregnant and pressurizing. Pressure will depend on the factor of safety of the casting.

#### 4.1.4 Autoclave

It is the impregnation vessel into which the components are loaded for the sake of either vacuum or vacuum/pressure impregnation.

### 5 CHOICE OF PROCESS

**5.1** The choice of process will depend upon the following:

- a) Nature of casting, shape, size and material;
- b) Type of sealant being used (see Annex A); and
- c) Working environment.

### 6 VACUUM IMPREGNATION

#### 6.1 Degreasing and Dehydration

The castings should be thoroughly degreased and dehydrated. After the degreasing operation, the castings should be allowed to cool to room temperature before continuing with the impregnation.

#### 6.2 Impregnation Cycle

The castings should be carefully packed into wire baskets, using dividers where necessary, to ensure good draining of surplus impregnant. Care is required to ensure that no damage is caused to machined surfaces at any stage in the process. The basket containing the castings should be loaded into the autoclave containing the impregnant. The autoclave is then sealed and evacuated to a vacuum equal to or better

than 755 mm of mercury. The cycle time would depend on the type of porosity and sealant being used ( *see* Annex C ).

### **6.3 Draining**

After release of the vacuum the castings should be removed from the autoclave and allowed to drain to recover surplus sealant. The basket should be tilted in different directions during the draining phase to ensure the removal of impregnant from blind holes and corners.

### **6.4 Cold Water Wash**

The castings should be washed in an agitated cold clean water rinse to remove surplus sealant film from all surfaces. They should then be drained for a short while to remove surplus water from blind holes and corners.

### **6.5 Cure Cycle**

Castings are cured either in hot water (90°C) for 10 minutes or in an oven (130°C) for 60 minutes or stored for a length of time at room temperature ( *see* Annex C ).

### **6.6 Inspection**

After impregnation, the casting should be visually checked to ensure that they are free of all excess resin on the machined or cast faces, in blind holes and along all screw threads. Any surplus resin must be removed.

### **6.7 Second Impregnation**

The castings should be pressure tested. If certain castings are found to be leaking, they may be reimpregnated once only, provided the leakage is only slight. Any major leakage seen after the first impregnation, should cause the casting to be rejected. Any leakage seen during pressure test after a second impregnation should also cause the castings to be rejected.

## **7 VACUUM PRESSURE IMPREGNATION**

**7.1** The clean and dry castings, heated if necessary, shall be placed in an empty pressure tank. The tank shall then be closed and the air exhausted there from until a vacuum of 685.8 mm of mercury is attained.

**7.2** The impregnating solution, which should be at a temperature compatible with the nature of the impregnating solution, shall be drawn into the tank, at such a rate that the vacuum specified in 7.1 is maintained. When the tank contains a sufficient amount of solution to cover the castings, to a level of at least 15 cm above the castings, pressure shall be applied. After a period which has been found by experience to be sufficient to seal porosity, has elapsed, the pressure shall be released, the tank emptied of the solution, and the castings removed.

## **8 INTERNAL HYDRAULIC PRESSURE IMPREGNATION**

**8.1** This technique may be used when it is not possible to place a casting in an autoclave. All the openings in the casting, except connections to fluid lines, shall be closed with plugs or plates and gaskets. The impregnating solution shall be poured or injected into the casting until the casting is completely full, or shall be circulated through the casting under pressure. The casting and the solution shall be at a temperature compatible with the nature of the impregnating solution. Hydraulic pressure from 3.5-5.3 kg/cm<sup>2</sup> above the prescribed pressure as mentioned in 4.1.2 (if factor of safety of the castings will permit) shall be applied. This pressure should cause the solution to seep through the pores, or in the case of extremely fine porosity, where the solution may not noticeably come outside to the surface and the inspector is satisfied that the pores are filled. Loss of solution by seepage may be stopped by spot curing. Care should be taken not to heat the castings unduly. In cases of minute porosity in heavy wall, 6 hours or more under pressure may be required to effect complete penetration of the solution through the wall.

## **9 DESPATCH FROM THE IMPREGNATOR**

**9.1** Castings should be securely packed and all machined surface protected against corrosion or damage during transit.

## **10 TYPES OF IMPREGNANTS AND APPLICATION PROCEDURES**

**10.1** Refer Annex A for details and different procedures to be used with different types of sealants.

## ANNEX A

[ Clauses 2.2, 5.1(b) and 10.1 ]

## VACUUM IMPREGNATION SYSTEM TECHNICAL DATA

( For Information Only )

| Sl No. | Type of Sealant           | Type of Process that may be Used                                               | Ultimate Vacuum to be Applied mm | Effective Penetration percent | Pot Life of Sealant | Frequency Testing of Sealant | Sealing Ability of Porosity |           | Number of Chemicals Used | Overall Application of System |
|--------|---------------------------|--------------------------------------------------------------------------------|----------------------------------|-------------------------------|---------------------|------------------------------|-----------------------------|-----------|--------------------------|-------------------------------|
|        |                           |                                                                                |                                  |                               |                     |                              | Gross                       | Macro     |                          |                               |
| (1)    | (2)                       | (3)                                                                            | (4)                              | (5)                           | (6)                 | (7)                          | (8)                         | (9)       | (10)                     | (11)                          |
| i)     | Thermocuring methacrylate | Vacuum impregnation                                                            | 759                              | 95                            | excellent           | once per week                | excellent                   | excellent | one                      | simple                        |
| ii)    | Anaerobic                 | a) Vacuum pressure impregnation<br>b) Internal hydraulic pressure impregnation | 710                              | 85                            | poor                | three times per day          | good                        | excellent | five                     | complex                       |
| iii)   | Sodium silicate           | a) Vacuum pressure impregnation<br>b) Internal hydraulic pressure impregnation | 715                              | 45                            | good                | once per week                | poor                        | very good | one                      | simple                        |
| iv)    | Polyester                 | a) Vacuum pressure impregnation<br>b) Internal hydraulic pressure impregnation | 715                              | 60                            | good                | once per week                | good                        | poor      | four                     | complex                       |

## ANNEX B

( Foreword )

## PROPERTIES OF SEALANTS

( For Information Only )

**B-1** Properties of different sealants are as follows:

**B-1.1 Thermocuring Methacrylate**

- a) Temperature resistant up to 760°C on water/air cooled components for short intermittent periods.
- b) Excellent resistance within castings to high pressure stress and flexings.

c) Penetrability excellent in both fine and gross porosity.

d) Not hazardous.

e) Odourless.

f) Chemical resistance include freon gases, hydraulic fluids, a wide range of acids and alkalies, antifreeze, engine oil, petrochemical products, brine, water, steam, etc.

**B-1.2 Anaerobic**

- a) High vacuum not to be used for fear of gelling up.
- b) Total degassing not possible.
- c) Process very complex.
- d) Dissolved air can encourage bleed out, if elevated temperature curing is used.

**B-1.3 Sodium Silicate**

- a) Low boiling point materials present in silicate and hence cannot achieve high vacuum.
- b) Should not be used on applications where vibrations are envisaged.
- c) Sodium silicate is brittle and can break down if tapped gently around the area of seal.
- d) Washing problems, castings exhibit deposits on machined surfaces. Hand washing is necessary to obtain cleanliness on castings.

- e) Application of heat causes sodium silicate to exude from the porosity which could result in seizure of moving parts.
- f) Not suitable for moving parts.
- g) High pH factor and hence corrosive on certain light alloys.
- h) System is now obsolete.

**B-1.4 Polyester**

- a) Low boiling material present and hence cannot achieve a very high vacuum.
- b) Viscosity very high and penetrability poor on fine porosity.
- c) Cannot be washed with water. Solvent required.
- d) Vapourisation of monomer results in thickening on the surface, which restricts ultimate drain off.
- e) Blended with styrene and other noxious materials for dilution purposes. Hazard from health and safety point of view.
- f) System is now obsolete.

**ANNEX C**( *Clauses 6.2 and 6.5* )**TREATMENT CYCLE TIME — ANALYSIS  
( For Information Only )**

| Chemical<br>Temperature<br>Resistance | Autoclave Cycle<br>Time ( Minutes ) |          |          | Centrifuge<br>Time<br>( Minutes ) | Drain<br>Station<br>Cycle<br>Time<br>( Min-<br>utes ) | Washing<br>Cycle<br>Time<br>( Min-<br>utes ) | Rins<br>Cycle<br>Time<br>( Min-<br>utes ) | Cure<br>Cycle<br>Time<br>( Min-<br>utes/<br>hrs ) | Total<br>Time<br>( Min-<br>utes ) |
|---------------------------------------|-------------------------------------|----------|----------|-----------------------------------|-------------------------------------------------------|----------------------------------------------|-------------------------------------------|---------------------------------------------------|-----------------------------------|
|                                       | Vacuum                              | Pressure | Unloaded |                                   |                                                       |                                              |                                           |                                                   |                                   |
| (1)                                   | (2)                                 | (3)      | (4)      | (5)                               | (6)                                                   | (7)                                          | (8)                                       | (9)                                               | (10)                              |
| Excellent at<br>50 to 300°C           | 10                                  | —        | 1        | —                                 | 2                                                     | 2<br>( Water )                               | —                                         | 10<br>( Hot<br>water )                            | 25                                |
| Very good at<br>40 to 200°C           | 10                                  | 20       | 2        | 3                                 | —                                                     | 2<br>( Deter-<br>gent )                      | 3<br>( Acti-<br>vator )                   | 180<br>( Room<br>temp )                           | 220                               |
| Good at<br>40 to 250°C                | 25                                  | 25       | 2        | —                                 | 2                                                     | 3<br>( Water )                               | 3<br>( Water )                            | 24 hrs<br>( Room<br>temp )                        | 25 hrs                            |
| Very good at<br>40 to 200°C           | 20                                  | 20       | 2        | 5                                 | —                                                     | 5<br>( Deter-<br>gent )                      | 2<br>( Water )                            | 45<br>( Oven/<br>oil )                            | 99                                |

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Doc : No. MTD 14 ( 3416 )

**Amendments Issued Since Publication**

| Amend No. | Date of Issue | Text Affected |
|-----------|---------------|---------------|
|           |               |               |
|           |               |               |
|           |               |               |

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